Yiming Che

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RESEARCH INTERESTS

Machine Learning/(Bayesian) Deep Learning, Probabilistic Model, Active Learning/Sequential Design, Uncertainty Quantification, Dynamics of Complex Systems

EDUCATION BACKGROUND

- **Binghamton University, State University of New York**
  Department of Systems Science and Industrial Engineering
  PhD. in Systems Science and Industrial Engineering   Expected May 2023
  advisor: Dr. Changqing Cheng

- **Binghamton University, State University of New York**
  Department of Systems Science and Industrial Engineering
  Master of Science in Industrial and Systems Engineering   May 2018
  advisor: Dr. Changqing Cheng

- **Capital University of Economics and Business (CUEB), Beijing, China**
  Department of Industrial Engineering
  Bachelor of Science in Industrial Engineering   July 2017

PROFESSIONAL EXPERIENCE

- **Student Mentoring**   2021-Present

  - Working on sparse learning and Bayesian sequential inference of network connectivity

- **Research Assistant at Binghamton University**   2019-Present

  - **Machine Learning/Deep Learning**
    - Physics-informed neural network (PINN) for COVID dynamics (current research)
      - Adopted spatial-temporal SEIR model, e.g., partial differential equation to model COVID dynamics
      - Adopted PINN for data assimilation
      - Trying to include Bayesian framework
    - Bayesian deep learning
      - Working on Bayes by Backpropagation and local reparameterization
      - Working on Hamiltonian Monte Carlo sampling
      - Trying to combine Bayesian deep learning and PINN
    - Deep Gaussian process (DGP) for improvement of its inference (current research)
      - Working on DGP with latent variables
      - Working on importance-weighted variational inference
    - Self-supervised learning, e.g., combination of self-supervised learning and active learning and Bayesian statistics (future research)

  - **Surrogate Modeling and Active Learning/Sequential Design**
    - Diverse gradient embeddings (BADGE) for regression case (current research)
    - Developed a novel surrogate model which combines generalized polynomial chaos and stochastic kriging model for efficient surrogate modeling of stochastic systems
      - Significantly reduced computational budget compared to Monte Carlo simulation

- – Achieved high accuracy with small computational budget
  - Developed a new expected improvement-based sampling algorithm with Gaussian process for active learning/sequential design
    - – Reduced size of training set by around 90%
    - – Achieved high accuracy when only a small fraction of training set is used
  - Developed a K-center-based sampling algorithm with relevant vector machine for active learning/sequential design
    - – Significantly reduced required training data to achieve high accuracy
  - Developed a batch-sampling strategy for efficient contour estimation
    - – Significantly reduced required training data to achieve high accuracy
    - – Significantly reduced training time
    - – Outperform the state-of-the-art method in several cases

- **Uncertainty Quantification**
  - Developed framework for generalized polynomial chaos expansion for uncertainty quantification of stability of chaotic systems with discrete delays
    - – Reduced computational budget of time-domain simulations for uncertainty quantification
    - – Devised maximum entropy method for density estimation

- **Teaching Assistant at Binghamton University**

  - SSIE-643 Advanced Engineering Analytics — 2020 Spring
  - SSIE-523 Dynamical System — 2019 Spring
  - SSIE-561 Quality Assurance — 2018 Fall

AWARD & HONOR

- INFORMS Bonder Foundation Award — 2021
- Finalist, IISE-DAIS Mobile App Competition at 2021 IISE Annual Conference and Expo — 2021
- Binghamton University Graduate Student Excellence Award in Research (**top 1%**) — 2021
- Travel Grant of Midwest Dynamical Systems Conference 2019 at University of Illinois at Chicago 2019
- Second Place, Best Student Paper Competition at 2019 IISE Annual Conference and Expo (Healthcare track) — 2019
- Honorable Mention, Binghamton University Research Day Poster Competition, 2018 — 2018
- National Scholarship at CUEB — 2015
- Scholarship for Academic Excellent Performance at CUEB — 2014
- Scholarship for Academic Excellent Performance at CUEB — 2013

CAREER DEVELOPMENT

- 2021 INFORMS Doctoral Colloquium — 2021
- 2020 IISE Doctoral Colloquium — 2020

JOURNAL PUBLICATIONS

1. **Che, Y.** and Cheng, C. "Physical-statistical learning towards resilience assessment for power generating systems," *Physica A: Statistical Mechanics and its Applications* . Under review.

2. **Che, Y.** and Cheng, C. "Dispersion-enhanced sequential batch sampling for contour estimation," *Quality and Reliability Engineering International.* Under review.

3. Ma, Q., **Che, Y.**, Cheng, C. and Wang, Z. "Characterizations and optimization for resilient manufacturing systems with considerations of process uncertainties," *Journal of Computing and Information Science in Engineering.* In press.

4. Wan, J., **Che, Y.**, Wang, Z. and Cheng, C. "Uncertainty quantification and optimal robust design for machining operations," *Journal of Computing and Information Science in Engineering.* In press.

5. **Che, Y.** and Cheng, C. "Active learning and relevance vector machine in efficient estimate for basin stability of dynamic networks," *Chaos: An Interdisciplinary Journal of Nonlinear Science* 31.5 (2021): 053129. https://doi.org/10.1063/5.0044899.

6. **Che, Y.**, Guo, Z. and Cheng, C. "Generalized polynomial chaos-informed efficient stochastic Kriging," *Journal of Computational Physics* (2021): 110598. https://doi.org/10.1016/j.jcp.2021.110598.

7. Wu, X., Zheng, Y., **Che, Y.** and Cheng, C. "Pattern recognition and automatic identification of early-stage atrial fibrillation," *Expert Systems with Applications* (2020): 113560. https://doi.org/10.1016/j.eswa.2020.113560.

8. **Che, Y.**, Cheng, C., Liu, Z. and Zhang, Z. "Fast basin stability estimation for dynamic systems under large perturbations with sequential support vector machine," *Physica D: Nonlinear Phenomena* (2020): 132381. https://doi.org/10.1016/j.physd.2020.132381.

9. **Che, Y.**, Liu, J. and Cheng, C. "Multi-fidelity modeling in sequential design for identification of stability region in dynamic time-delay systems," *Chaos: An Interdisciplinary Journal of Nonlinear Science* 29.9 (2019): 093-105. https://doi.org/10.1063/1.5097934.

10. **Che, Y.** and Cheng, C. "Uncertainty quantification in stability analysis of chaotic systems with discrete delays," *Chaos, Solitons & Fractals* 116 (2018): 208-214. https://doi.org/10.1016/j.chaos.2018.08.024.

CONFERENCE POSTERS AND PRESENTATIONS

1. **Che, Y.** and Cheng, C. "Active learning and relevance vector machine in efficient estimate for basin stability of dynamic networks," Northeast Regional Conference on Complex Systems (2021).

2. **Che, Y.** and Cheng, C. "Generalized polynomial chaos-informed efficient stochastic kriging," INFORMS (2020).

3. **Che, Y.** and Cheng, C. "Sequential design for generalized polynomial chaos-informed efficient stochastic kriging," IISE Annual Conference and Expo (2020).

4. **Che, Y.** and Cheng, C. "Sparse learning and Bayesian sequential inference of network connectivity," IISE Annual Conference and Expo (2020).

5. **Che, Y.** and Cheng, C. "Fast basin stability estimation for dynamic systems under large perturbations with sequential support vector machine," Northeast Regional Conference on Complex Systems (2020).

6. **Che, Y.** and Cheng, C. "Polynomial-chaos-based stochastic Gaussian process," INFORMS (2019), Seattle, WA, U.S.

7. **Che, Y.** and Cheng, C. "Identification of early-stage atrial fibrillation with intrinsic properties of RR intervals," IISE Annual Conference and Expo (2019), Orlando, FL, U.S.

8. **Che, Y.** and Cheng, C. "Multi-fidelity modeling in sequential design for identification of stability region in dynamic time-delay systems," IISE Annual Conference and Expo (2019), Orlando, FL, U.S.

9. **Che, Y.** and Cheng, C. "Uncertainty quantification in stability analysis of chaotic systems with discrete delays," Northeast Regional Conference on Complex Systems (2018), Binghamton, NY, U.S.

PROFESSIONAL SERVICES

- Student member, Student leadership board at IISE   Mar. 2021-Present

- Vice president, ASQ Binghamton chapter   Aug. 2019-Present

PROFESSIONAL AFFILIATIONS

- Institute of Industrial and Systems Engineers

- Institute for Operations Research and the Management Sciences

- Society for Industrial and Applied Mathematics